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PROCESS AND DEVICE FOR REGENERATING A CONTAMINATED SOLVENT

PROCEDE ET DISPOSITIF DE REGENERATION D'UN SOLVANT CONTAMINE

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verbunden sind, um diese zur Nachdestillation mindestens ein weiteres Mal durch den Verdampfer (26) in den Kondensator (40) zu führen.

Claims

1. Process for regenerating a contaminated solvent with separation of contaminating foreign substances, in which foreign substances whose boiling point is above the boiling point of the pure solvent are separated in an evaporator (26) continuously in a first process step, and foreign substances whose boiling point is below the boiling point of the pure solvent are separated in a condenser (40) in a second process step, wherein pure solvent is condensed out in the condenser (40) and discharged and the foreign substances whose boiling point is below the boiling point of the pure solvent and optionally water are discharged from the condenser (40) in vaporous state, characterized in that the temperature of the vaporous foreign substances on leaving the condenser (40) and the temperature of the condensed pure solvent on leaving the condenser (40) are controlled as follows by means of a closed separate cooling circuit whose coolant flows through the condenser:

   - the temperature of the coolant on entering the condenser (40) is controlled by means of a control device allocated to the coolant circuit, by which means the temperature of the vaporous foreign substances leaving on the same side of the condenser (40) is set;
   - the temperature of the condensed pure solvent on leaving the condenser (40) is controlled by means of the flow quantity of the coolant of the cooling circuit flowing through the cooling pipes of the condenser.

2. Process according to Claim 1, characterized in that the temperature of the coolant on entering the condenser (40) is controlled via a control valve (59) arranged in a bypass to a cooler (58), which valve is controlled by the temperature of the vaporous foreign substances on leaving the condenser (40).

3. Process according to one of the preceding Claims, characterized in that the contaminated solvent is injected into the evaporator (26) in liquid form, wherein a part of the contaminated solvent and the foreign substances whose boiling point is below the boiling point of the pure solvent evaporate immediately, and the other part of the contaminated solvent and the foreign substances whose boiling point is above the boiling point of the pure solvent sink down into a solvent bath (29).

4. Process according to Claim 3, characterized in that the contaminated solvent is injected into the evaporator (26) into the chamber above the surface of the solvent bath (29).

5. Process according to Claim 3 or 4, characterized in that before being injected into the evaporator (26) the contaminated solvent is heated by a flow heater (22) to an injection temperature which is preferably between 10 °C and 20 °C above the evaporation temperature of the solvent at the internal pressure prevailing in the evaporator (26).

6. Process according to one of Claims 3 to 5, characterized in that the solvent bath is heated and is controlled for level control to a volume which corresponds to 5% to 20% of the hourly overall regeneration quantity of solvent.

7. Process according to one of Claims 3 to 6, characterized in that the solvent bath (29) is evaporated down to a non-evaporable residue for a time of 3 to 12 minutes by periodic interruption of the solvent injection into the evaporator (26), whereupon this residue is completely discharged from the evaporator (26).

8. Process according to Claim 7, characterized in that the residue is automatically discharged from the evaporator (26) by means of a time circuit.

9. Process according to one of the preceding Claims, characterized in that the pure solvent is removed from the condenser (40) by means of a sluice system.

10. Process according to Claim 9, characterized in that the pure solvent is pre-cooled by a cooler (44) connected upstream of the sluice system.

11. Process according to one of the preceding Claims, characterized in that the closed separate cooling circuit and the condenser (40) are brought to the desired operating temperature before and/or when the process begins by means of a start-up heating (76).

12. Process according to one of the preceding Claims, characterized in that the foreign substances whose boiling point is below that of the pure solvent, and optionally water vapour, are extracted from the condenser (40) via a liquid ring pump, downstream of which a ring liquid separator (64) is connected, wherein the pressure in the condenser (40) and in the evaporator (26) is controlled via the temperature of the ring liquid.

13. Process according to Claim 12, characterized in that the foreign substances drawn off from the con-

denser (40) and the water optionally drawn off from the condenser (40) are separated in the ring liquid separator (64), collected separately and removed separately so that the foreign substances serving as operating liquid of the liquid ring pump contain no water.

14. Process according to one of the preceding Claims, characterized in that before being supplied to the evaporator (26) the contaminated solvent is roughly purified of settling water and settling foreign substances in a settling tank (1).

15. Process according to Claim 14, characterized in that the roughly purified solvent is removed from the settling tank (1) via outlets (10, 11) which are located at different heights and are each controlled by float switches (2, 3) which are arranged just below them and rise in water.

16. Process according to Claim 15, characterized in that the outlet in question (10, 11) is closed when the corresponding float switch (3, 2) rises in water.

17. Process according to one of the preceding Claims, characterized in that the vaporous foreign substances and optionally co-evaporated solvent, which are discharged from the condenser(40), are supplied to the evaporator (26) and to the condenser (40) at least one further time and are post-distilled in one or more post-distillation steps.

18. Process according to Claim 17, characterized in that no supply of new contaminated solvent to the evaporator (26) takes place during post-distillation and that the vaporous foreign substances, and the coevaporated solvent, are collected in a separate container (80, 81, 82) after each distillation step.

19. Device for regenerating a contaminated solvent with separation of contaminating foreign substances, with an evaporator (26) for separating foreign substances whose boiling point is above the boiling point of the pure solvent, and a condenser (40) arranged downstream of the evaporator (26) for separating foreign substances whose boiling point is below the boiling point of the pure solvent, wherein the condenser (40) has an inlet for the vapour coming from the evaporator (26) and an outlet for condensed pure solvent, and an outlet for the vaporous foreign substances whose boiling point is below the boiling point of the pure solvent, characterized in that the coolant of a closed separate cooling circuit flows through the condenser (40), that the closed cooling circuit has a control device (58, 59) for setting the temperature of the coolant on entering the condenser (40), which thus serves to set the temperature of the vaporous foreign substances when leaving the condenser (40) on the same side, and that the closed cooling circuit has a circulating pump (60) for controlling the flow quantity of the coolant in the condenser, which thus serves to set the temperature of the condensed pure solvent on leaving the condenser (40).

20. Device according to Claim 19, characterized in that the control device comprises a cooler (58) and a control valve (59), arranged in a bypass thereto, which is controlled by the temperature of the vaporous foreign substances on leaving the condenser.

21. Device according to one of Claims 19 to 20, characterized in that the evaporator (26) is in the form of a flash evaporator in the upper part and as a bubble evaporator with heated bottom in the lower part.

22. Device according to Claim 21, characterized in that the evaporator has a cylindrical form, wherein the injection of the solvent takes place into the upper part of the evaporator.

23. Device according to Claim 22, characterized in that the lower part of the evaporator has a solvent bath (29) whose volume is controllable to 5% to 20% of the hourly overall regeneration quantity of the solvent.

24. Device according to Claim 23, characterized in that a filter layer (A, B) is arranged in the evaporator (26) above the surface of the solvent bath (29).

25. Device according to Claim 24, characterized in that the filter layer (A, B) is arranged in the evaporator above the injection (30) of the solvent.

26. Device according to one of Claims 19 to 25, characterized in that the pure solvent can be removed from the condenser (40) via a sluice system (42).

27. Device according to Claim 26, characterized in that a cooler (44) for pre-cooling the pure solvent is connected upstream of the sluice system.

28. Device according to one of Claims 19 to 27, characterized in that the closed separate cooling circuit has a start-up heating (76) by means of which the condenser (40) may be brought to the desired operating temperature before and/or when the process begins.

29. Device according to one of Claims 19 to 28, characterized by a liquid pump for extracting the vaporous foreign substances and water vapour from the condenser (40), downstream of which a ring liquid separator (64) is connected.

30. Device according to Claim 29, characterized in that the ring liquid separator (64) has a collecting tank, the central part of which has a bath provided with a cooling coil (68) for the separated foreign substances from which the operating liquid for the liquid ring pump is taken, and the lower part of which has a separation tank (66) for the separated water.

31. Device according to Claim 30, characterized in that the ring liquid separator (64) has two overflows by means of which the surplus foreign substances and the water may be separately discharged and disposed of.

32. Device according to one of Claims 19 to 31, characterized in that a flow heater (22) which heats the contaminated solvent prior to entry into the evaporator (26) is arranged in front of the evaporator (26).

33. Device according to one of Claims 19 to 32, characterized by a settling tank (1) arranged in front of the evaporator (26) for the rough purification of the contaminated solvent of settling water and settling foreign substances.

34. Device according to Claim 33, characterized in that the settling tank (1) has outlets (10, 11) which are located at different heights and are controllable by corresponding float switches (3, 2) each arranged just underneath.

35. Device according to Claim 34, characterized in that the float switches (2, 3) rise in water but not in solvent.

36. Device according to Claim 35, characterized in that a float switch (4) rising in solvent is arranged in the settling tank (1) just above the two float switches (2, 3) rising in water.

37. Device according to Claim 36, characterized in that a float switch (5) rising in solvent and serving as overfill protection is arranged on the upper edge of the settling tank (1).

38. Device according to one of Claims 29 to 37, characterized in that the ring liquid separator (64) and the evaporator (26) are connected via one or more collecting tanks (80, 81, 82) to receive the vaporous foreign substances discharged from the condenser (40) and co-evaporated solvent, in order to guide these through the evaporator (26) into the condenser (40) at least one further time for post-distillation.

Revendications

1. Procédé de retraitement d'un solvant pollué avec séparation de substances étrangères polluantes, dans lequel, dans une première étape de procédé, les substances étrangères dont le point d'ébullition est supérieur au point d'ébullition du solvant pur sont séparées en continu dans un vaporisateur (26) et, dans une seconde étape de procédé, les substances étrangères dont le point d'ébullition est inférieur au point d'ébullition du solvant pur sont séparées dans un condenseur (40), le solvant pur étant condensé dans le condenseur (40) et évacué, et les substances étrangères dont le point d'ébullition est situé sous le point d'ébullition du solvant pur, ainsi éventuellement que l'eau, sont évacuées du condenseur (40) à l'état gazeux, caractérisé en ce que la température des substances étrangères gazeuses à la sortie du condenseur (40) et la température du solvant pur condensé à la sortie du condenseur (40) sont régulées au moyen d'un circuit fermé de refroidissement séparé dont le réfrigérant traverse le condenseur, de la manière suivante :

   - la température du réfrigérant à l'entrée du condenseur (40) est réglée au moyen d'un dispositif de réqulation associé au circuit de réfrigérant, de sorte que la température des substances étrangères gazeuses qui sortent du même côté du condenseur (40) est ajustée ;
   - la température du solvant pur condensé à la sortie du condenseur (40) est régulée au moyen du débit du réfrigérant du circuit de refroidissement qui s'écoule dans les tubes de refroidissement du condenseur.

2. Procédé selon la revendication 1, caractérisé en ce que la température du réfrigérant à l'entrée du condenseur (40) est régulée par l'intermédiaire d'une vanne de régulation (59) disposée dans une dérivation d'un refroidisseur (58), qui commande la température des substances étrangères gazeuses à la sortie du condenseur (40).

3. Procédé selon l'une des revendications précédentes, caractérisé en ce que le solvant pollué est injecté à l'état liquide dans le vaporisateur (26), une partie du solvant pollué et les substances étrangères dont le point d'ébullition est inférieur au point d'ébullition du solvant pur s'évaporant immédiatement, et l'autre partie du solvant pollué et les substances étrangères dont le point d'ébullition est supérieur au point d'ébullition du solvant pur tombant dans un bain de solvant (29).

4. Procédé selon la revendication 3 caractérisé en ce que le solvant pollué est injecté dans l'espace au-dessus de la surface du bain de solvant (29) dans le vaporisateur (26).